

**REMARKS FOR DEPUTY ADMINISTRATOR LORI GARVER
CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES
April 26, 2010**

Thank you, John. It's a pleasure to be here.

I know you have all read and heard a fair amount about President Obama's new space enterprise and saw the coverage of his visit to the Kennedy Space Center in Florida a week and a half ago. We are gratified that the President feels strongly enough about space exploration that he visited one of NASA's field centers in person to explain and further define his deep commitment to NASA and our nation's future in space.

There's been some misunderstanding of this new direction. And let me be clear, it is indeed a bold direction, as well as a clear path. The President's strategy will allow NASA to create a more exciting and productive space exploration future for our nation than it has today. While at times in recent years it seemed as though NASA was repeating the past, now we'll have the means and the mandate to create the future.

On the CSIS website, the space initiatives section describes the dichotomy of approaches to space exploration. It says that "Some of these are bold and expansive, envisioning a deep and long-term commitment to the discovery and settlement of space. Other visions are more constrained, focused on near-term and incremental progress. The decisions that the world's space-faring nations make about which type of vision to pursue will determine what the next era of space exploration looks like."

We couldn't agree more. President Obama has clearly set us on the bold side of the equation. And yet, we are also going to be making near term and incremental progress on the path to an expansive future. We want to take initiative and reach for the horizon, as the President said – be transformative. And yes, we think that is do-able.

NASA Administrator Charlie Bolden told Congress last week that he thinks what the President has put forward is the most authentically visionary policy for real human space exploration that we have had since President Kennedy challenged NASA to send humans to the Moon and return them safely back to Earth. And while previous administrations have announced space policies well into their terms, President Obama is doing this early and has promised his 100% commitment to it.

This new direction is sustainable, not only in that it provides actual money for real activities in a logical sequence, but also because it makes the difficult choices. There are no unfunded mandates here. No programs that are expected to launch, orbit or be maintained with only paper backing.

And at the core, it is a change to the way we do business. As Charlie himself said at the President's space conference in Florida the week before last, this is an intellectual conversation that the country should have been having 40 years ago, post-Apollo. (I

guess I would argue that there has been a sub-set of the community that has been doing that). At that crucial time of major success, we should have been planning the next giant leaps. We have had those conversations now. The President has thought long and hard about the path for space exploration. He declared, quote, that "Space exploration is not a luxury, it's not an afterthought in America's quest for a brighter future – it is an essential part of that quest."

With that strong vote of confidence and the promise in his budget request of the resources to make it happen, NASA has been rapidly making progress on the blueprint for implementing the President's direction. We understand that a realignment of our priorities and a more expansive vision of what we can accomplish is unsettling in some quarters. (I would suggest it is not the "radical" change that some have characterized). But we are confident that once people learn more about our plans and as more details are finalized, there will be broad consensus that this is the direction America needs to head if it is to continue to be the leader among space-faring nations, with all the economic and societal benefits that unfold from that hard-earned position. We will not only continue our space leadership for years to come, we will expand and enhance it.

The President said "In short, fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn, operate and live safely beyond the Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity's reach in space, we will strengthen America's leadership here on Earth."

In order to carry out this expansion of humanity, we have to develop the propulsion systems to get us there, large habitats that also shield and protect our crew, and the means to sustain these explorers for longer and longer periods of time. And that's just for starters. We need to develop these technologies and others to allow us to sustainably develop space. The President thought long and hard about this new direction. He truly wants us to accomplish more, to finally develop a more meaningful space odyssey. To correct the under-investment in research and development that has hampered our previous space exploration efforts. And to provide future generations with far more capabilities than we have today.

In short, we must invest both in fundamentally new innovations for space technology, and new ways of doing business, if we are to develop a space exploration and development program that is truly sustainable over the long term. The President has given us a road map that will allow us to increase our capabilities in a progressive fashion as we approach an ever increasing number of targets with an increasing difficulty in these missions. Technology advances will enable each step. First, we'll demonstrate technologies near Earth, capabilities such as fuel depots, inflatable habitats, advanced life support systems and autonomous rendezvous and docking. Simultaneously, robotic precursors will be fanning out across the solar system, giving us knowledge about potential destinations and providing a great dividend in scientific discovery even as they, too, help us demonstrate important technologies such as

precision landing, in space propulsion and in-situ resource utilization that must be demonstrated and then scaled up for human exploration applications.

On the technology side, upon approval of the Fiscal Year 2011 budget, we will be quickly moving out on promising development in several areas. With lack of investment, many of these technologies have remained in the conceptual phase for decades. With the support provided by the President's FY2011 budget request, we can advance these capabilities, which have applicability across a broad range of NASA missions. We will begin advancing these space systems in FY11 and accomplish critical testing in FY2012 and FY2013 that would prove their fundamental feasibility.

Among these advanced space systems:

Solar Sails that provide propulsion without fuel, using the momentum of reflected sunlight to propel spacecraft to orbits and destinations impossible to attain with conventional propulsion.

Optical Communication, which impacts both NASA's future data capacity needs and its spacecraft size reduction goals. Wideband high data rate communication will enable live transmission of high resolution images, and optical communications will be necessary for high-definition TV images of future missions. The National Research Council identified optical communications as one of NASA's key technology investment areas.

Aerocapture, a flight maneuver designed to decelerate a spacecraft from hyperbolic approach to a captured orbit during only one pass through an atmosphere, without the significant use of propellant.

Electrodynamic Tether Propulsion, which provides indefinite LEO reboost, station keeping and maneuvering without the use of propellant.

Inflatable habitats, decelerators and other structures that provide packaging volume savings as well as weight savings that can be translated to additional payload capacity

Advanced in-space propulsion systems capable of more efficient transit throughout the solar system.

In-situ resource utilization systems that will allow our explorers to live off the land and capitalize on the resources of a range of destinations.

And of course, while we're working on developing these in-space technologies with our industry and academic partners -- things that we'll need to successfully travel into deep space -- work will be accelerated on the heavy lift propulsion system that will carry us there. In this effort, we'll be testing the untested and creating more robust and efficient rocket engines. By 2015, per the President's directive, we'll know what kind of heavy-lift vehicle we're going to build.

Clearly, we do not intend to face these challenges alone. We will build on NASA's long and successful history of international cooperation, continue working closely with our existing partners and even invite new non-traditional partners to join us in the implementation of our exploration plans.

That's the outline of our technology and demonstration plans.

Before we reach the surface of Mars with humans, we'll explore an asteroid, by 2025. The President announced that unprecedented goal in Florida. NASA engineers have been looking at candidates for a NEO mission that could launch in 2025. Because of orbital dynamics, launch date drives the specific destination. We are discovering new NEOs all the time, so our list of targets will certainly expand over the coming years. One intriguing candidate is asteroid 1999AO10, which we could reach with a 2025 launch on a 150 day round trip mission, spending about 2 weeks at the asteroid.

But why would we want to visit an asteroid in the first place? Why are these space rocks such compelling destinations for humans? First, they provide an intermediate destination for human exploration, with round trip times significantly longer than the Moon but shorter than Mars. They also don't require a high gravity landing, perhaps making them even more accessible than the Moon from a hardware development standpoint. Next, asteroids are fascinating scientifically, as evidenced by the National Academy's endorsement of their exploration in Decadal Surveys and other reports. They are remnants of the birth of our solar system – they preserve the primitive materials from which our earth, and possibly even life, formed. Some asteroids are very rich in valuable metals, and may be important space resources. And finally, we know NEOs are important for life on Earth because they have affected our evolution through mass extinctions they have caused.

The bottom line is, NEOs represent one of only a handful of threats that could wipe out humanity. It is not a question of WHETHER we will be hit by an extinction-scale NEO in the future, but merely WHEN this will happen. Only by gaining experience operating at these objects might it be possible to someday prevent one from changing the course of humanity's future. One issue with exploring NEOs with humans is that the U.S. has only operated around the largest NEO, with the robotic mission NEAR. The Japanese have visited another. But most of these objects are still very mysterious to us. We know very little about 1999AO10, potentially our most promising target. This is where our Exploration Precursor Robotic missions come into play. With these missions, we can explore potential candidates, and provide ground truth for our Earth-based telescopic observations of NEOs.

These are truly tangible reasons for making a NEO, one of our first destinations for humans in deep space. And I have to add, it is incredible how well Hollywood taps in to the psyche and true desires of the public, so having something appear in a movie is not necessarily a bad thing. The public is fascinated by NEOs, and I am sure they are also a little afraid, to be honest. A recent poll just completed by the Everett Group found that sixty-three percent of those who said exploring space was at least somewhat important

cited protecting the Earth from collisions with comets and asteroids as a major reason for continuing that exploration. NASA has been working, and in the new budget ramps up, the activity of cataloging and characterizing NEOS. If one is going to pose a danger to Earth, we need to know about it, and by visiting one, we'll have that much better of an understanding of what it might take to mitigate potential future collisions.

A mission to a NEO will also test our deep space propulsion systems, since we're talking about 5 million miles of travel as opposed to around 239,000 to reach the Moon. They'll test our ability to orient ourselves and explore on an alien world. They'll test the habitat, radiation protection and life support systems we'll be developing for human beings in deep space. All in all, they're a tough destination. And Mars will be even tougher.

I was a child of the Space Race. It permeated our country in every way. It was a central part of pop culture. It was in water cooler discussions and academic venues. Our scientists and engineers were engaged in a project of broader reach than most of them had ever before experienced.

We have a different set of circumstances today. The good thing is, those circumstances do not include a Cold-War race. Our plan is based on positive, exciting circumstances that allow us to pursue this space exploration path in collaboration with our international neighbors. Back when I was a child watching the first rockets launch to the moon, we had no idea, for instance, that Saturn had a moon of its own that was spouting water into space, and that we'd be able to fly through those plumes and send pictures back to Earth. Who back then knew that we would today be able to keep astronauts safe in orbit above the Earth 24/7 for extended periods of time in a system the size of a football field, built collectively by nations around the globe? Who knew that we would be able to combine human and robotic exploration so effectively in the repair of a national treasure like the Hubble Space Telescope?

All of you here today are well aware of the many policy issues surrounding space exploration, the limitations, the pros and cons. So I want to get to the heart of the issue, "How are we going to do this?"

The President's policy is a new direction but it is not a break from the knowledge and achievements of the past. We'll be expanding on the huge depth of expertise and, yes, passion, that is NASA, even as we change the way we do business and get back into the business of innovation. NASA is big, but it needs to also become nimble. We're working hard on this challenge. The agency is one of the biggest engines for research and development in the biggest R&D investor in the world, the United States. In the fiscal year 2011 President's budget, there is a total of about \$147 billion for research and development across the federal government. About \$66 billion of this is for nondefense R&D. NASA's budget for FY11 is \$19 billion, and approximately 45% of this budget can be characterized as R&D (both by NASA, academia and industry). So you can see that NASA is one of the largest nondefense R&D agencies in the U.S. So

NASA is a key part of the nation's R&D investment – and therefore a key part of the “innovation equation” that leads to US economic growth.

Innovation is best done rapidly. It thrives on energy and momentum, a ferment of many attempts. In the President's plan for NASA, we will be developing a broad portfolio of technologies and will be executing a vast array of missions. Many of these will succeed, but we are not averse to failure because in cutting-edge endeavors, failure is an important part of how we learn.

In addition to that bottom line question, "What will it take to create the vibrant space exploration enterprise that we see unfolding in the future?" we ask "How can we increase America's capabilities in space, open vast new possibilities for new markets and new capabilities, and have a populace that is inspired by space?"

As Norm Augustine, chair of our Review of U.S. Human Spaceflight Plans Committee and a moderator at the President's conference in Florida said, we need to jumpstart innovation. Right now, the technological cupboard is bare. The missions we want to do can't be done without new technology. For instance, at this point, the mass required to initiate a human mission to Mars in low Earth orbit is approximately 12 times the mass of the space station. Think about that. We've been building the ISS for years. But we are not daunted! We think, for instance, that we should be able to get that down to two times the mass of ISS.

The President's plan takes into account the need for targeted investment in technology development that will enable us to become a truly spacefaring nation. It also spurs the development of an entire economic sector that is poised for massive growth, freeing up NASA to develop new deep space capabilities, and along the way generate cascades of scientific knowledge and benefits to people on Earth.

In short, the President has outlined an ambitious effort to foster the development of ground breaking technologies; increase the number, scope, and pace of human and robotic space missions; make human spaceflight safer and more efficient; and help create thousands of jobs.

Fundamentally, the exploration of space will be a sequence of deep-space human destinations matched to growing capabilities, progressing step-by-step, beginning with crewed flight tests, early in the next decade, of the capabilities and vehicles needed for human exploration beyond low Earth orbit. Then there's that human mission to an asteroid by 2025, and a human mission to orbit Mars and return safely to Earth by 2035.

NASA is currently developing concepts and top-level requirements for four proposed Flagship Technology Demonstration missions that will demonstrate these capabilities: cryo-fluid management and transfer; automated/autonomous rendezvous and docking, advanced space power systems, high power electric propulsion, light weight inflatable structures, closed-loop life support systems, and aero-assist/entry decent and landing technology.

The President's call to action for NASA assumes increased cooperation with our international partners, focusing initially on extending operations of the International Space Station. Just last month in Tokyo the heads of space agencies from Europe, Japan, Canada and United States came together to reaffirm the importance of extending the space station program and discussed the incredible opportunities it will provide as a testbed for future human and robotic space exploration activities.

The ISS is an incredible resource. It's going to help us from the human health side of exploration and also be the driver for the commercial capabilities that will be a key resource for us in the coming years. The President has proposed to extend its lifespan, likely to 2020 or beyond. And working closely with our international partners we are going to make that happen and begin to fully utilize this incredible investment that America has made in our human space exploration enterprise.

The ISS is a marvel of construction, and the process of building it has led to breakthroughs in water processing and closed loop life support and human-robotic interaction. Perhaps its greatest achievement is that of collaboration -- 16 nations working together for the peaceful advancement of spaceflight.

At the space conference in Florida last week, the panel on ISS utilization featured entrepreneurs as well as astronauts who have worked on the station. They agreed that we need to increase operational tempo and flights to the station, and we need to develop parallel paths to assure our success.

This is exactly what we want to do. By helping to create multiple, redundant access to space approaches, we are advancing our national capabilities. As one panelist said, there is nothing unique about access to space that should make it government forever. In fact he said, it is too important to leave just to the federal government.

We see the increase in reliance on commercial capabilities as a new but incredibly valuable development. This approach will decrease our reliance on foreign providers. Pursuing this direction gives us more options in the long run and has the benefit of spurring a whole new segment of the economy that we expect to be long lasting and productive of thousands of good jobs in the near term and many more as it expands in the future. Only in America would we take such an approach -- one of innovation, ingenuity and commercial competition. In addition, for crew escape, we will develop a capsule based on Constellation's Orion, with the potential to fly on rockets that already exist.

And let me address the safety argument here. Safety will remain our prime concern in any system that brings humans to space. Our commercial providers will have had many launches under their belts before any potential commercial crew mission. The bottom line is that NASA will be there every step of the way, and won't let astronauts fly on the

vehicles that have not successfully gone through a rigorous human rating process. Period.

If you really want to break this down, lives already depend on commercial companies, because industry is trusted to launch critical national security missions, upon which the lives of our troops overseas depend. Further, our commercial partners have already demonstrated significant reliability: 21 successful flights of the Atlas V have already taken place, and by 2014, Falcon and Taurus will have had a dozen flights before attempting to fly with people onboard. Thirteen former astronauts said in a Wall Street Journal op-ed that they are confident commercial spaceflight can be done safely. Those very astronauts have flown aboard vehicles that were built by commercial providers with NASA overseeing safety, just as we will do in the future.

Along with the ISS and a commercial focus on access to LEO, we will accelerate work on a heavy lift propulsion system. Our 2015 vehicle decision timeline means that major work on building a new heavy lift rocket will begin sooner than was previously planned. In addition, these technologies will be transferred to the military and commercial sectors – so that they too can benefit from this national investment. We have lost nearly the entire commercial space launch market over the past decade and our defense partners are extremely anxious to partner with us in these development efforts for our mutual benefit.

As I mentioned earlier, a key component of the President's direction is a renewed emphasis on the importance of international partnerships in NASA's future human space exploration activities. Building on the work to date among the 14 space agencies that contributed to the Global Exploration Strategy, we will also initiate a new series of discussions with our partners to discuss many of the initiatives I have outlined here for you today. The goal of these discussions will be to identify opportunities for enhanced international cooperation in almost all aspects of the President's new direction for our agency.

When I was in Florida at the President's conference on space exploration in the 21st century, I moderated a panel on Harnessing Space to Expand Economic Development. Consider, for example, the 21st century launch complex initiative, which seeks to transform the Kennedy Space Center into a state of the art launch facility serving multiple customers that will be the model for others like it around the country and around the world. It leverages investment, develops partnerships with the DOD, and helps make a diversified business case for Florida.

A refrain we hear a lot is, "Why should we support space exploration?" The bottom line is that technology and R&D investment leads to greater job creation and economic growth. Space technology development transfers to real people, with societal benefits in higher quality of life, better education, and a stronger economy. These investments strengthen the skills of our workforce and our nation in challenging technology areas.

Some have suggested that the massive influx we are proposing in technology development could be something like what happened when the Internet exploded. Is that possible? I believe we are ripe for a significant expansion of our technological workforce and a myriad of spinoff benefits that we can't even envision right now.

By focusing our R&D efforts on technologies that are of general use to the American aerospace industry - as we did with the NACA -- the precursor to NASA -- as well as to NASA's missions, we can improve our national economic competitiveness and capture a greater share of the growing international market for commercial space products and services, which is currently around \$175 billion.

A few startling statistics for those of you out here who, like me, love this stuff:

The U.S. share of satellite manufacturing revenues has fallen from 63% in the 1996-1998 timeframe to 29% in 2008 according to Satellite Industry Association Reports.

The U.S. share of worldwide launch revenues is down from 48% in 1996 to 28% in 2008 according to the association. An increase of just 10% (of \$175B) would nearly repay NASA's entire annual budget.

We can get that business back and more. And we will. Certainly some of the downturn is related to our export control policies, and those are being reformed as well. As you heard from Secretary Gate's announcement last week -- the White House is leading an effort with, Department of State, Department of Commerce, and Department of Defense working on export control reforms as we speak.

This combination of activities I've been discussing today is flexible. It represents missions enabled by capability, guided by discovery, with many destinations, milestones and achievements as we go. And I am confident that it will keep people engaged as we progress. Live video from an asteroid? The first human photos from Mars orbit? Robots landing on the moons of Mars and other places where we've never been?

So, a quick re-cap:

In the next decade we'll have: Full operation of ISS and human research breakthroughs, flagship demos, the beginnings of robotic precursors, a decision on heavy lift and commercial capabilities online for low Earth orbit.

By 2025, missions to asteroids with other deep space destinations, including Mars, to follow.

I know today I've just spoken about exploration, because that seems to be the area that requires the greatest explanation, but this new budget also has great things for Science, especially climate research and monitoring, as well as the next wave of robotic Mars missions that will vastly increase our knowledge of the Red Planet, and for green aviation, which will make air travel safer for all of us and easier on the environment. I

think Charlie Bolden is speaking here a little later this year and perhaps he can go into greater detail then. I know my time is limited, so I wanted to make the points I did today about our dynamic new plan for exploration.

We think this program is sustainable not only in terms of dollars but in terms of the public's support, in making space exploration part of the national psyche again.

We are changing the game. It's no longer just about where we want to go, but why we want to go and what we want to achieve when we get there. This activity will lead to new opportunities for the economy, new knowledge and capabilities, and step by step progress toward far reaching milestones.

We're stretching beyond barriers that have defined our limits for years. This plan will take us beyond what any other nation on Earth can do.. We're excited, and I hope you are, too. Thank you.